Unbalanced osmotic pressure would lead any system composed of semi-permeable membranes to its detruction by osmolysis or plasmolysis. In order to avwid such unbalanced osmotic pressure, cellular systems had to develop an energetically active mechanis that would allow them to pump model. The model contains the following elements: structural membrane elements (*Lm*), transdrcers (*T*), molecules which combine enzyme-like molecules through the membrane (*E*), energy-rich molecules (*A*), precursors of each type of molecule (*l, t, e* and *a*, respectively) and an ionic substance (x). The energetic and kinetic conditions for the system to be energetically and osmotically coherent are presented. These conditions must lie on the set of kinetic parameters that allow the existence of kinetically stable steady states. Thus, this model provides insight about the need for energetic and osmotic balances to be mechanistically coupled in primitive celluar systems. The quantitative relations that the system could be osmotically balanced during the transition between different stationary states will be slso discussed.

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P-97. A MODEL FOR COMPARTMENTALIZATION OF A PRIMITIVE CELL

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It has been previously found that N-(O,O-dialkyl) phosphoryl amino acids could oligomerize into peptides in aqueous solution (Zhao et al., 1995) and incubation of N-phosphoryl amino acid with nulcleoside could lead to simultaneous formation of peptides and nucleotides (Zhou et al., 1996). Therefore, Zhao et al proposed the interaction of N-phosphoryl amino acids with nucleosides as a model for co-evolution of proteins and nucleic acids (Zhao and Cao, 1994). However, our recent work indicates that the supramolecular structure of vesicles from amphiphilic N-phosphoryl amino acid could block the interaction of N-phosphoryl amino acid with nucleosides effectively, which could be regarded as an experimental evidence of the compartmentalization of the primitive cell from the surroundings. An synthesized lipid N-(O,O-dihexadecyl) phosphoryl amino acids could self-assembly into stable unilamellar vesicles under appropriate conditions. The incubation of the vesicular suspensions could lead to the formation of dipeptide, which was confirmed by ESI-MS. It is considered that the suitable orientation and packing of amphiphilic molecules at the vesicle/water interface together with certain conformational freedom in the vesicular bilayer are favorable for the condensation in ordered systems as vesicles. However, The incubation of the vesicular dispersions entrapping nucleoside did not result in the formation of oligonucleotide through the interaction of phosphoryl alanine and nucleoside, as in the case of the bulk system in the aqueous or organic solutions. The effective compartmentalization is believed to be due to the separation of the two species in different phases – inner aqueous phases and lipid bilayers of the vesicles. The observations showed that amphiphilic N-phosphoryl amino acid could be a model for the evolution of cell membranes besides its significance as the model of the evolution of biopolymolecules.

References

Zhao, Y.F., Ju, Y., Li, Y.M., et al.: 1995, *Int. J. Pept. Prot. Res.* **45**, 514–518.
Zhou, W.H., Ju, Y., Zhao, Y.F., et al.: 1996, *Origins Life Evol. B.* **26**, 547–560.
Zhao, Y.F. and Cao, P.S.: 1994, *J. Biol. Phys.* **20**, 283–287.

P-99 A HYPOTHESIS OF ORIGIN OF THE BACKBONE OF NUCLEIC ACID – EFFICIENT SYNTHESIS OF 3′, 5′-DITHIO-2′-DEOXYPURINENUCLEOSIDES

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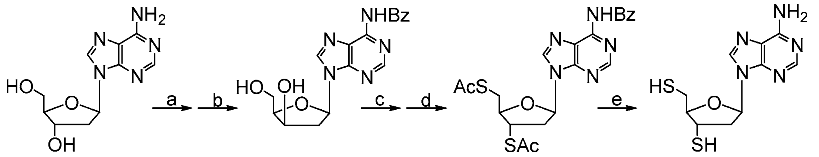
As well known, the formation of nucleic acids with phosphodiester backbone is very difficult under simulated prebiotic conditions. Our recent research shows that the reactions of 3′, 5′-Dithio-2′-Deoxynucleosides with HCHO can easily afford a novel nucleic acid with -S-CH_2-S- linkages under mild conditions. Thus, we propose a



Scheme 1. Reaction conditions: a) (1) BzCl, C_5H_5N; (2) Me_3SiCl, BzCl, MeOH, NH_3, 80%; b) (1) $(CF_3SO_2)_2O$, C_5H_5N, CH_2Cl_2, H_2O; (2) MeOH, MeONa, 70%; c) MsCl, C_5H_5N, 91%; d) AcSK, Dioxane, N_2, 60 °C, 36 h, 77%; e) EtSH, EtSNa, N_2, 85%.